Condensing Oil-Fired Furnace

Installation Maintenance and Operation Manual

! WARNING

Do not store gasoline flammable liquids or vapors in the vicinity of this or any other fuel burning appliance.

! CAUTION

Improper installation, adjustment, alteration or maintenance can cause injury or property damage. Please refer to this manual. For assistance or additional information, contact a qualified installer or service agency.

c UL us

Please leave this manual with the homeowner.

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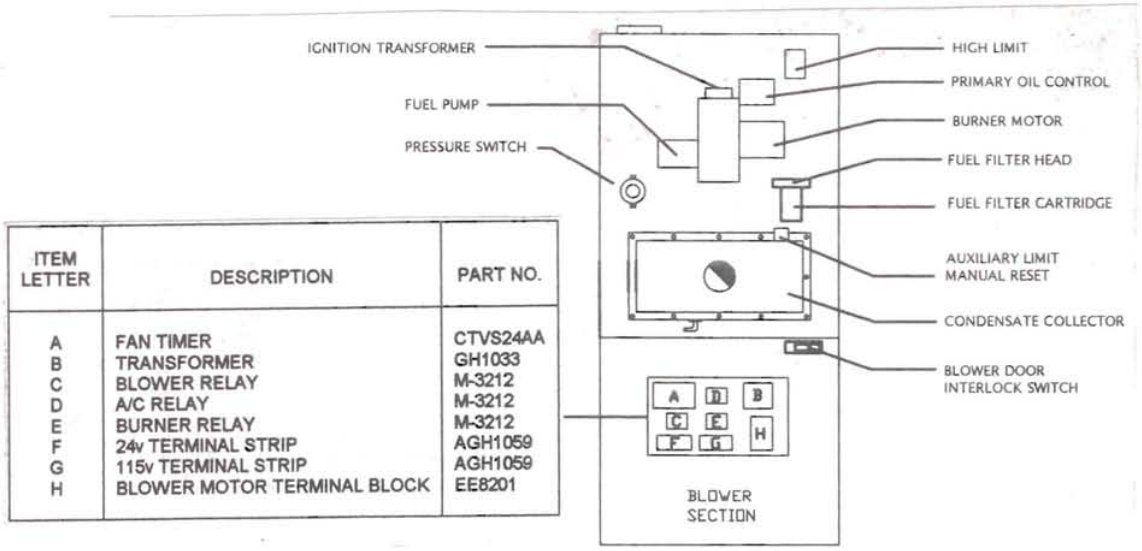
I. Component Identification



ITEM LETTER	DESCRIPTION	PART NO.
A	FAN TIMER	CTVS24AA
B	TRANSFORMER	GH1033
C	BLOWER RELAY	M-3212
D	A/C RELAY	M-3212
E	BURNER RELAY	M-3212
F	24v TERMINAL STRIP	AGH1059
G	115v TERMINAL STRIP	AGH1059
H	BLOWER MOTOR TERMINAL BLOCK	EE8201

Figure 1

II. SAFETY

Please adhere to the following warnings and cautions when installing, adjusting, altering, servicing, or operating the furnace.

Important

The following instruments must be used to adjust the burner on startup.
Failure to use the proper instruments will void our warranty and will result in an unsatisfactory installation.

Bacharach Electronic Combustion Analyzer
Bacharach Smoke Tester
(Or equivalent to above)
Oil Pressure Gauge

! WARNING

TO PREVENT PERSONAL INJURY OR DEATH DUE TO IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE, REFER TO THIS MANUAL. FOR ADDITIONAL ASSISTANCE OR INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICE AGENCY OR THE FUEL OIL SUPPLIER.

! WARNING

HIGH VOLTAGE!
TO AVOID PROPERTY DAMAGE, PERSONAL INJURY OR DEATH DUE TO ELECTRICAL SHOCK, THE FURNACE MUST BE LOCATED TO PROTECT THE ELECTRICAL COMPONENTS FROM WATER.

! WARNING

DO NOT UTILIZE THE HEATING UNIT WITHOUT REASONABLE ROUTINE INSPECTION, MAINTENANCE AND SUPERVISION. IF THE UNIT IS IN A BUILDING THAT IS OR WILL BE VACANT, CARE SHOULD BE TAKEN TO ROUTINELY INSPECT, MAINTAIN AND MONITOR THE UNIT. IN THE EVENT THAT THE BUILDING MAY BE EXPOSED TO FREEZING TEMPERATURES AND WILL BE VACANT, DRAIN ALL WATER-BEARING PIPES, PROPERLY WINTERIZE THE BUILDING AND TURN OFF ALL WATER SOURCES. IN THE EVENT THAT THE BUILDING IS EXPOSED TO FREEZING TEMERATURES AND IS VACANT, ANY HYDRONIC COIL UNITS SHOULD ALSO BE DRAINED AND AN ALTERNATIVE HEAT SOURCE UTILIZED.

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! WARNING

WE WILL NOT BE RESPONSIBLE FOR ANY INJURY OR PROPERTY DAMAGE ARISING FROM IMPROPER SERVICE OR SERVICE PROCEDURES. IF YOU INSTALL OR PERFORM SERVICE ON THIS UNIT, YOU ASSUME RESPONSIBILLITY FOR ANY PERSONAL INJURY OR PROPERTY DAMAGE WHICH MAY RESULT. MANY JURISDICTIONS REQUIRE A LICENSE TO INSTALL OR SERVICE HEATING AND AIR CONDITIONING EQUIPMENT.

INSTALLATION AND SERVICE MUST BE PERFORMED BY A QUALIFIED INSTALLER, SERVICE AGENCY OR FUEL OIL DEALER.

DANGER
PELIGRO

CARBON MONOXIDE POISONING HAZARD

To The Installer

Before installing this unit, please read this manual thoroughly to familiarize yourself with specific items which must be adhered to, including, but not limited to: unit maximum external static pressure, oil pressure, BTU input rating, proper electrical connections, circulating air temperature rise, minimum or maximum CFM, and motor speed connections.

TRANSPORTATION DAMAGE

All units are securely packed in shipping containers tested according to International SafeTransit Association specifications. The carton must be checked upon arrival for external damage. If damage is found, a request for inspection by carrier's agent must be made in writing immediately.

1. Make a notation on delivery receipt of any visible damage to shipment or container.
2. Notify carrier promptly and request an inspection.
3. With concealed damage, carrier must be notified as soon as possible – preferably within five days.
4. File the claim with the following support documents within a nine month statute of limitations.
    - Original or certified copy of the Bill of Lading, or indemnity bond.
    - Original paid freight bill or indemnity in lieu thereof.
    - Original or certified copy of the invoice, showing trade and other discounts or reductions.
    - Copy of the inspection report issued by carrier's representative at the time damage is reported to carrier.

The carrier is responsible for making prompt inspection of damage and for a thorough investigation of each claim. The distributor or manufacturer will not accept claims from dealers for transportation damage.

Keep this literature in a safe place for future reference.

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III. PRODUCT APPLICATION

This furnace is primarily designed for residential home-heating applications. It is NOT designed or certified for use in mobile home, trailers or recreational vehicles. This unit is NOT designed or certified for outdoor applications. The furnace **must** be installed indoors (i.e., attic space, crawl space, or garage area provided the garage area is enclosed with an operating door).
This furnace can be used in the following non-industrial commercial applications:

Schools, Office buildings, Churches, Retail stores, Nursing homes, Hotels/motels, common or office areas
In such applications, the furnace must be installed with the following stipulations:

- It must be installed per the installation instructions provided and per local and national codes.
- It must be installed indoors in a building constructed on site.
- It must be part of a ducted system and not used in a free air delivery application.
- It must not be used as a "make-up" air unit.
- This furnace may NOT be used as a construction site heater.

To ensure proper installation and operation, thoroughly read this manual for specifics pertaining the installation and application of this product.

! WARNING

Possible property damage, personal injury or death due to fire, explosion, smoke, soot, condensation, electrical shock or carbon monoxide may result from improper installation, repair, operation or maintenance of this product.

! WARNING

To prevent personal injury, property damage or death due to fire, do not install this furnace in a mobile home, trailer or recreational vehicle.

To ensure proper furnace operation, install, operate and maintain the furnace in accordance with these installation and operation instructions, all local building codes and ordinances.

INSTALLATION CODES

INSTALLATION MUST COMPLY WITH THE REQUIREMENTS OF AUTHORITIES HAVING JURISDICTION.

All local and national codes governing the installation of oil burning equipment, wiring, and venting must be followed. Some of the applicable codes are:

CAN/CSA B139 Installation Code for Oil Burning Equipment.
NFPA 31 Installation Code for oil Burning Equipment
ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.
ANSI/NFPA 70 National Electrical Code.
CSA C22.1 Canadian Electrical Code.
ANSI/NFPA 211 Chimneys, Fireplaces, Vents and Solid Fuel Burning Appliances.

A copy of the CAN/CSA B139 Installation Codes can be obtained from:

CSA International
178 Rexdale Boulevard
Etobicoke, Ontario, Canada M9WIR3
or
CSA International
8501 East Pleasant Valley
Cleveland, OH 44131

The rated heating capacity of the furnace should be greater than or equal to the total heat loss of the area to be heated. The total heat loss should be calculated by an approved method or in accordance with "ASHRAE Guide" or "Manual J-Load Calculations" published by the Air Conditioning Contractors of America.

IV. LOCATION REQUIREMENTS & CONSIDERATIONS

GENERAL

! WARNING

TO PREVENT POSSIBLE EQUIPMENT DAMAGE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH, THE FOLLOWING BULLET POINTS MUST BE OBSERVED WHEN INSTALLING THE UNIT.

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Follow the instructions listed below when selecting a furnace location.
Refer also to the guidelines provided in Section V. Combustion and Ventilation Air Requirements.

- Centrally locate the furnace with respect to the proposed or existing air distribution system.

- Ensure the temperature of the return air entering the furnace is between 55 F and 90 F when the furnace is heating.

- Provide provisions for venting combustion products outdoors through a proper venting system. Special consideration should be given to vent/flue pipe routing and combustion air intake pipe when applicable. Refer to Section IX, Vent/Flue Pipe and Combustion Air Pipe Termination Locations for appropriate termination locations and to determine if the piping system from furnace to termination can be accomplished within the guidelines given.

- **NOTE:** The length of flue and/or combustion air piping can be a limiting factor in the location of the furnace.

- Locate the furnace so condensate flows downwards to the drain. Do not locate the furnace or its condensate drainage system in any area subject to below freezing temperatures without proper freeze protection. Refer to Section X. Condensate Drain Lines and Trap for further details.

- Ensure adequate combustion air is available for the furnace. Improper or insufficient combustion air can expose building occupants to combustion products that could include carbon monoxide. Refer to Section V., Combustion and Ventilation Air Requirements.

- Set the furnace on a level floor to enable proper condensate drainage. If the floor becomes wet or damp at times, place the furnace above the floor on a concrete base sized approximately 1-1/2 times larger than the base of the furnace.

Exposure to contaminated combustion air will result in safety and performance related problems. Do not install the furnace where the combustion air is exposed to the following substances:

Chlorinated waxes or cleaners
Chlorine-based swimming pool chemicals
Water softening chemicals
Deicing salts or chemicals
Carbon tetrachloride
Halogen type refrigerants
Cleaning solutions (such as perchloroethylene
Printing inks
Paint removers
Vanishes
Hydrochloric acid
Cements and glues
Antistatic fabric softeners for clothes dryers.
Masonry acid washing materials

- Seal off a non-direct vent furnace if it is installed near an area frequently contaminated by any of the above substances. This protects the non-direct vent furnace from airborne contaminants. To ensure that the enclosed non-direct vent furnace has an adequate supply of combustion air, vent from a nearby uncontaminated room or from outdoors. Refer to the Section V. combustion and Ventilation Air Requirements for details.

- If the furnace is used in connection with a cooling unit, install the furnace upstream or in parallel with a cooling unit. Premature heat exchanger failure will result if the cooling unit is placed ahead of the furnace.
- If the furnace is installed in a residential garage, position the furnace so that the burner and ignition source are located not less than 18 inches (457 mm) above the floor. Protect the furnace from physical damage by vehicles.

Clearances and Accessibility

Installations must adhere to the clearances to combustible materials to which this furnace has been design certified. The minimum clearance information for this furnace is provided on the units rating label.

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These clearances must be permanently maintained. Clearances must also accommodate an installation's oil, electrical, and drain trap and drain line connections. If the alternate vent/flue connections are used additional clearance must be provided to accommodate these conditions Section IX, Vent Flue Pipe and Combustion Air Pipe for details.

NOTE: In addition to the required clearances to combustible materials, a minimum of 24 inches service clearance must be available in front of the unit.
A clearance of 24 inches at the rear of the unit is also recommended.

Thermostat Location
The thermostat should be placed approximately five feet from the floor on a vibration-free, inside wall in an area having good air circulation. Do not install the thermostat where it may be influenced by any of the following:

- Drafts or dead spots behind doors, in corners, or under cabinets.
- Hot or cold air from registers.
- Radiant heat from the sun.
- Light fixtures or other appliances.
- Radiant heat from a fireplace.
- Concealed hot or cold water pipes, or chimneys.
- Unconditioned areas behind the thermostat, such as an outside wall.

V. COMBUSTION & VENTILATION AIR REQUIREMENTS

! WARNING

TO AVOID PROPERTY DAMAGE, PERSONAL INJURY OR DEATH, SUFFICIENT FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES MUST BE SUPPLIED. MOST HOMES REQUIRE OUTSIDE AIR BE SUPPLIED INTO THE FURNACE AREA.

Improved construction and additional insulation in buildings have reduced heat loss by reducing air infiltration and escape around doors and windows. These changes have helped in reducing heating/cooling costs, but have created a problem supplying combustion and ventilation air for burning appliances.

Appliances that pull air out of the house (exhaust fans, fireplaces, clothes dryers, etc.) increase the problem by starving appliances for air.
House depressurization can cause back drafting or improper combustion of oil fired appliances, thereby exposing building occupants to combustion products that could include carbon monoxide and cause:

1. Nausea-Headaches-Dizziness, Flu-Like symptoms.
2. Excessive humidity – heavily frosted windows or a moist feeling in the home.
3. Smoke from a fireplace will not draw up the chimney.
4. Flue gases that will not draw up the appliance vent pipe.

Combustion and Ventilation Air

Adequate provisions for combustion air, ventilation of furnace, and dilution of the gases must be made. When a furnace is installed in an unconfined space in a building, it can be assumed that infiltration will be sufficient to supply the required air.

If the furnace is installed in a confined space and combustion air is taken from the heated space, the supply air and ventilating air must be through two permanent openings of equal area. A confined space is "a space whose volume is less than 50 cubic feet per 1000 BTU per hour of the combined input rating of all appliances installed in that space." One opening must be within 12" of the ceiling and the other within 12" of the floor. Each opening must have a minimum free area of at least 1 square inch per 1000 BTU per hour of total input rating of all appliances within the space but not less than 100 square inches.

If the furnace is installed in a space within a building of tight construction and air must be supplied from outdoors. In this case, one opening shall be within 12" of the ceiling and the other within 12" of the floor.

If vertical combustion ducts are run, each opening must have a free area of at least 1 square inch per 4000 BTU per hour.

If horizontal combustion ducts are run, 1 square inch per 2000 BTU per hour of the total input of all appliances is required.

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A return air duct system is recommended. Where there is no complete return air duct system, a return connection should be run full size to a location outside the confined space and completely sealed so that no air from the confined space can be circulated through the heating duct system.

EXISTING FURNACE REMOVAL

NOTE: When an existing furnace is removed from a venting system serving other appliances, the venting system may be too large to properly vent the remaining attached appliances.

If this furnace is to be installed in the same space with other oil fired appliances, such as a water heater, ensure there is an adequate supply of combustion and ventilation air for the other appliances.

VI. VENT/FLUE PIPE & COMBUSTION AIR PIPE

! WARNING

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN BODILY INJURY OR DEATH. CAREFULLY READ AND FOLLOW ALL INSTRUCTIONS GIVEN IN THIS SECTION.

! WARNING

UPON COMPLETION OF THE FURNACE INSTALLATION, CAREFULLY INSPECT THE ENTIRE FLUE SYSTEM BOTH INSIDE AND OUTSIDE OF THE FURNACE TO ASSURE IT IS PROPERLY SEALED. LEAKS IN THE FLUE SYSTEM CAN RESULT IN SERIOUS PERSONAL INJURY OR DEATH DUE TO EXPOSURE TO FLUE PRODUCTS, INCLUDING CARBON MONOXIDE.

A condensing oil furnace achieves its high level of efficiency by extracting almost all of the heat from the products of combustion and cooling them to the point where condensation takes place. Because of the relatively low flue gas temperature and water condensation requirements, PVC pipe is used as venting material. This furnace must not be connected to Type B, BW, or L vent or vent connector, and must not be vented into any portion of a factory built or masonry chimney, except when used as a pathway for PVC as descried later in this section. Never common vent this appliance with another appliance or use a vent which is used by a solid fuel appliance.

Do not use commercially available "no hub connector" other than those shipped with this product.

It is the responsibility of the installer to follow the manufacturers' recommendations and to verify that all vent/flue piping and connectors are compatible with furnace flue products. Additionally, it is the responsibility of the installer to ensure that all piping and connections possess adequate structural integrity and support to prevent flue pipe separation, shifting, or sagging during furnace operation.

MATERIALS AND JOINING METHODS

! WARNING

TO AVOID BODILY INJURY, FIRE OR EXPOLSION, SOLVENT CEMENTS MUST BE KEPT AWAY FROM ALL IGNITION SOURCES (I.E., SPARKS, OPEN FLAMES AND EXCESSIVE HEAT) AS THEY ARE COMBUSTIBLE LIQUIDS. AVOID BREATHING CEMENT VAPORS OR CONTACT WITH SKIN AND/OR EYES.

Three-inch nominal diameter PVC Schedule 40 pipe meeting ASTM D1785, PVC primer meeting ASTM F6566, and PVC solvent cement meeting ASTM D2564 specifications must be used. Fittings must be DWV type fittings meeting ASTM D2665 and ASTM D3311. Carefully follow the manufacturer's instructions for cutting, cleaning, and solvent cementing of PVC.

As an alternative to PVC pipe, primer, solvent cement, and fittings, ABS materials which are in compliance with the following specifications may be used. Three-inch ABS Schedule 40 pipe must meet ASTM D1527 and, if used in Canada, must be CSA listed solvent cement for ABS to PVC transition joint must meet ASTM D2235 and, if used in Canada must be CSA listed. The solvent cement for the PVC to ABS transition joint must meet ASTM D3138. Fittings must be DWV type fittings meeting ASTM D 2661 and ASTM D3311 and, if used in Canada, must be CSA listed. Carefully follow the pipe manufacturers' instructions for cutting, cleaning, and solvent cementing PVC and/or ABS.

All 90 elbows must be medium radius (1/4 bend DWV) or long radius (Long sweep ¼ bend DWV) types conforming to ASTM D3311. A medium radius (1/4 bend DWV) elbow measures 4-9/16 minimum from the plane of one opening to the centerline of the other opening for 3" diameter pipe.

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PROPER VENT/FLUE AND COMBUSTION AIR PIPING PRACTICES

Adhere to these instructions to ensure safe and proper furnace performance.

The length, diameter, and number of elbows of the vent/flue pipe and combustion air pipe effects the performance of the furnace and must be carefully sized.

All piping must be installed in accordance with local codes and these instructions.

Piping must be adequately secured and supported to prohibit sagging, joint separation, and/or detachment from the furnace.
Horizontal runs of vent/flue piping must be supported every three to five feet and must maintain a ¼ inch per foot downward slope, back towards the furnace, to properly return condensate to the furnace's drain system.

Precautions should be taken to prevent condensate from freezing inside the vent/flue pipe and/or at the vent/flue pipe termination.

All vent/flue piping exposed to freezing temperatures below 35 F for extended periods of time must be insulated with ½" thick closed cell foam.

Also all vent/flue piping exposed outdoors in excess of the terminations shown in this manual (or in unheated areas) must be insulated with ½" thick closed cell foam. Inspect piping for leaks prior to installing insulation.

TERMINATION LOCATIONS EXHAUST VENT/INLET AIR LOCATION

1. The vent piping for this furnace is approved for zero clearance to combustible construction.

2. The condensing oil furnace, like all high efficiency products, is likely to produce a visible vapor plume due to condensation. Surfaces near the vent termination will likely be coated with condensation.

3. Care must be taken to locate the exhaust vent where the exhaust gas, vapor plume, and condensation do not cause a hazard or nuisance. For example, so not locate the exhaust vent termination under a deck where, under certain conditions, it could form a coating of ice causing a hazard or reduce the life of the deck materials.

Fitting Description	Equivalent Length
Elbow, 90	5
Cleanout Tee	5
Elbow, 45	3
Vertical Vent Termination	0
Sidewall Vent Termination	0

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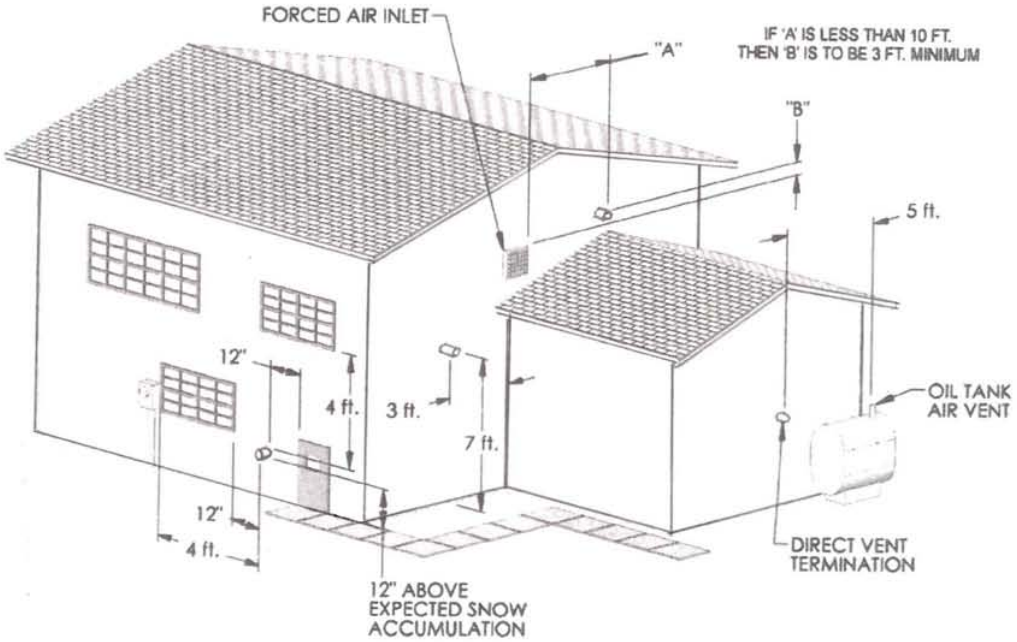
Sidewall Vent System

a) Sidewall vented products are susceptible to wind conditions that can effect combustion. To minimize the effects of wind, exhaust and air inlet terminations must penetrate the same wall or vertical surface. In addition, the length of the exhaust and air inlet pipes must be roughly equivalent.
b) Condensation from a sidewall vented appliance may cause paint and other surface coatings to deteriorate. In addition, soot stains may appear on surrounding surfaces if the furnace is not properly maintained.
c) See Figure 2 for an illustration of clearances for location of exit terminals for direct-vent, sidewall venting systems.
d) The vent system shall terminate at least 3 feet above any forced air inlet located within 10 feet. NOTE: This does not apply to the combustion air inlet of a direct-vent appliance.
e) Provide a minimum of 1 foot distance from any door, operable window, or gravity air inlet into any building.
f) Do not locate the exhaust termination directly under an operable window.
g) Provide a minimum of 1 foot clearance from the bottom of the exhaust termination above the expected snow accumulation level. Snow removal may be necessary to maintain clearance.
h) Provide 4 feet horizontal clearance from electrical meters, gas meters, air conditioning condensers or other external equipment. In no case shall the exit terminal be above or below the aforementioned equipment unless a 4 foot horizontal distance is maintained.
i) Do not locate the exit termination over public walkways where condensate could drip or freeze, causing a hazard or nuisance.
j) When the exhaust termination is adjacent to a public walkway, it is to be located at least 7 feet above grade.
k) Do not locate exhaust termination directly under roof overhangs to prevent icicles from forming.
l) Provide 3 feet clearance from the inside corner of adjacent walls.

The vent termination of a non-direct vent application must terminate at least 4 feet below, 4 feet horizontally from, or 1 foot above any door, window, or gravity air inlet into any building.



Location of Exit Terminals of Mechanical Draft and Direct-Venting Systems

Figure 2

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STANDARD FURNACE CONNECTIONS

It is the responsibility of the installer to ensure that the piping connections to the furnace are secure, airtight, and adequately supported.
All furnaces are shipped with a combustion air connection on the cabinet exterior and a flue connector on the inside of the cabinet on the condensate collector box.

VENT/FLUE PIPE

Vent/flue pipe can be secured to the vent/flue coupling using the rubber coupling and worm gear hose clamps provided with this furnace (see "Standard connections" figure). The rubber coupling allows separation of the vent/flue pipe from the furnace during servicing.

Combustion Air and Vent piping should be routed in a manner to avoid contact with refrigerant lines, metering devices, condensate drain lines, etc. If necessary, clearances may be increased by utilizing two 45 degree Long-Sweep Elbows and creating an "S" joint to provide additional space at connection locations. This joint can be rotated on the fitting to establish maximum clearance between refrigerant lines, metering devices, and condensate drain lines, etc. This joint is the equivalent of one 90 degree elbow when considering elbow count.

NOTE: Do not use other commercially available "no hub connectors" due to possible material conflicts. The vent/flue pipe can also be secured using a PVC or ABS elbow or coupling using the appropriate glue (see Section VI, Materials and Joining Methods).

VENT/FLUE AND COMBUSTION AIR PIPE LENGTHS

Refer to the following table for applicable length, elbows, and pipe diameter for construction of the vent/flue and combustion air intake pipe systems of a direct vent (dual pipe) installation. The number of elbows tabulated represents the number of elbows and/or tees in each (Vent/Flue & Combustion Air Intake) pipe. Elbows and/or tees used in the terminations must be included when determining the number of elbows in the piping systems.

If the combustion air intake pipe is to be installed above a finished ceiling or other area where dripping of condensate will be objectionable, insulation of the combustion air pipe may be required. Use ½" thick closed cell foam insulation such as Armaflex or Insultube where required.

Non-Direct or Direct Vent (Dual Pipe)
Three (3) Inch Pipe Diameter
Maximum Allowable Length of Vent/Flue and Combustion Air Intake Pipe (ft.)

Unit Input BTU	Vent/flue/Air Intake Pipe Termination	Maximum Allowable Length of Vent/Flue Pipe (ft.) — Number of Elbows						
		2	3	4	5	6	7	8
50,000 75,000 100,000 125,000	Standard	68	65	62	59	56	53	50
50,000 75,000 100,000 125,000	Alternate	55	52	49	46	43	40	37

Notes:

1. Minimum requirement for each vent pipe is five (5) feet in length and one elbow/tee.
2. Tee used in the vent/flue termination must be included when determining the number of elbows in the piping system.
3. 3" diameter
4. Increased Clearance Configurations using (2) 45 degree Long Sweep elbows should be considered equivalent to one 90 degree elbow.

Vent/Flue and combustion Air Pipe Terminations

The vent/flue and combustion air pipes may terminate vertically, as through a roof, or horizontally, as through an outside wall. Vertical pipe terminations should be as shown in the following figure. Refer to Section VI Vent/Flue Pipe and Combustion Pipe Termination Locations for details concerning location restrictions. The penetrations through the roof must be sealed tight with proper flashing such as is used with a plastic plumbing vent.

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Installations require both a vent/flue pipe and a combustion air intake pipe. Refer to the appropriate section for details concerning piping size, length, number of elbows, furnace connections, and terminations.

DIRECT VENT (DUAL PIPE) PIPING – BECKETT NX
NON-DIRECT VENT (DUAL PIPE) INTERburner

Installations require both a combustion air intake and a vent/flue pipe. The pipes may be run horizontally and exit through the side of the building or run vertically and exit through the roof of the building.

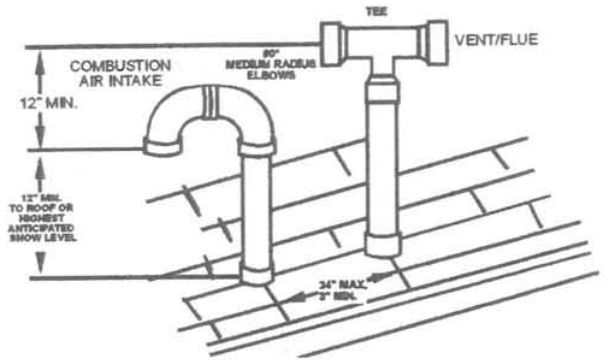
The pipes may be run through an existing unused chimney; however, they must extend a minimum of 12 inches above the top of the chimney.

The space between the pipes and the chimney must be closed with a weather tight, corrosion resistant flashing. Both the combustion air intake and vent/flue pipe terminations must be in the same atmospheric pressure zone.

Refer to Section VI, Vent/flue and Combustion air Pipe – Termination Locations or Concentric Vent Termination for specific details on termination construction.
For details concerning connection of pipes to the furnace, refer to the Section VI, Vent/Flue Pipe and Combustion Pipe – Standard Furnace connections or alternate furnace connections.

ROOF VENT SYSTEM

The vent termination of vent pipe run vertically through a roof must terminate at least 12 inches above the roof line (or the anticipated snow level) and be at least 12 inches from any vertical wall (including any anticipated snow build up).

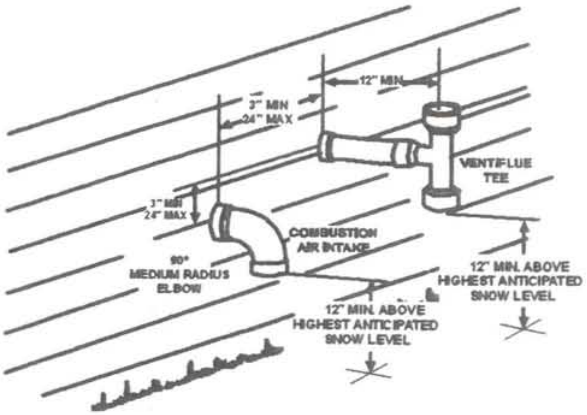


Vertical Terminations (Dual Pipe)

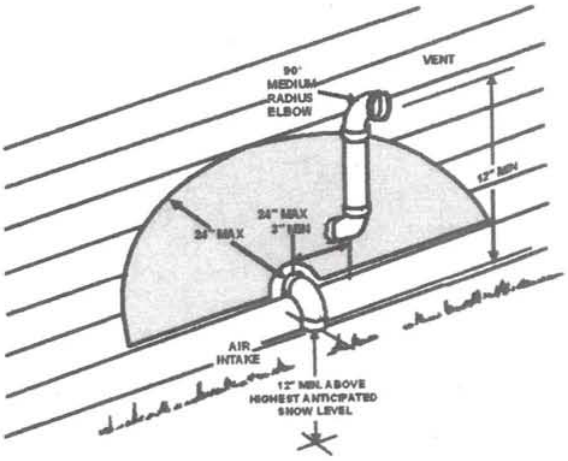
Horizontal terminations should be as shown in the following figure. Refer to Section VI, Vent/Flue Pipe and Combustion Pipe – Termination Location for location restrictions.

A 3 ½ inch diameter hole is required for 3" diameter pipe. To secure the pipe passing through the wall and prohibit damage to piping connections, a coupling should be installed on either side of the wall and solvent cemented to a pipe connecting the two couplings.

The pipe length should be the wall thickness plus the depth of the socket fittings to be installed on the inside and outside of the wall. The wall penetration should be sealed with silicone caulking material.



Standard horizontal Terminations (Dual Pipe)



Alternate Horizontal Vent Termination (Dual Pipe)

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VII. ELECTRICAL CONNECTIONS

! WARNING

HIGH VOLTAGE!
To avoid the risk of electrical shock, wiring to the unit must be polarized and grounded.

! WARNING

HIGH VOLTAGE!
To avoid personal injury or death due to electrical shock, disconnect electrical power before servicing or changing any electrical wiring.

! CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

Wiring Harness

The wiring harness is an integral part of this furnace. Field alteration to comply with electrical codes should not be required. Wires are color-coded for identification purposes. Refer to the wiring diagram for wire routings. If any of the original wire as supplied with the furnace must be replaced, it must be replaced with wiring material having a temperature rating of at least 105 degrees C. Any replacement wiring must be copper conductor.

115 Volt Line Connections

Before proceeding with electrical connections, ensure that the supply voltage, frequency, and phase correspond to that specified on the unit rating plate. Power supply to the furnace must be N.E.C. Class 1, and must comply with all applicable codes. and/or The Canadian Electric Code CSA C22.1.

Use a separate fused branch electrical circuit containing properly sized wire, minimum 12 gauge, and fuse or circuit breaker.
The furnace must be electrically grounded in accordance with local codes or, in their absence, with the latest edition of:

The National Electric Code, ANSI NFPA 70.
The fuse or circuit breaker must be sized in accordance with the maximum over-current protection specified on the unit rating plate.
An electrical disconnect must be provided at the furnace location.

NOTE: Line polarity must be observed when making field connections.

! WARNING

THE DRAIN TRAP MUST VBE MOUNTED ON THE OPPOSITE SIDE OF THE UNIT FROM THE JUNCTION BOX. THIS WILL REDUCE THE RISK OF WATER REACHING THE JUNCTION BOX IN THE EVENT OF A BLOCKED DRAIN CONDITION.

Connect hot, neutral, and ground wires as shown in the wiring diagram located on the unit's blower door. Line polarity must be observed when making field connections. Line voltage connections can be made through either the right or left side panel. The furnace is shipped configured for a right side electrical connection with the junction box located inside the blower compartment. To make electrical connections through the opposite side of the furnace, the junction box must be relocated to the other side of the blower compartment prior to making electrical connections.
NOTE: Wire routing must not interfere with circulator blower operation, filter removal, or routine maintenance.

! WARNING

EDGES OF SHEET METAL HOLES MAY BE SHARP. USE GLOVES AS A PRECAUTION WHEN REMOVING HOLE PLUGS.

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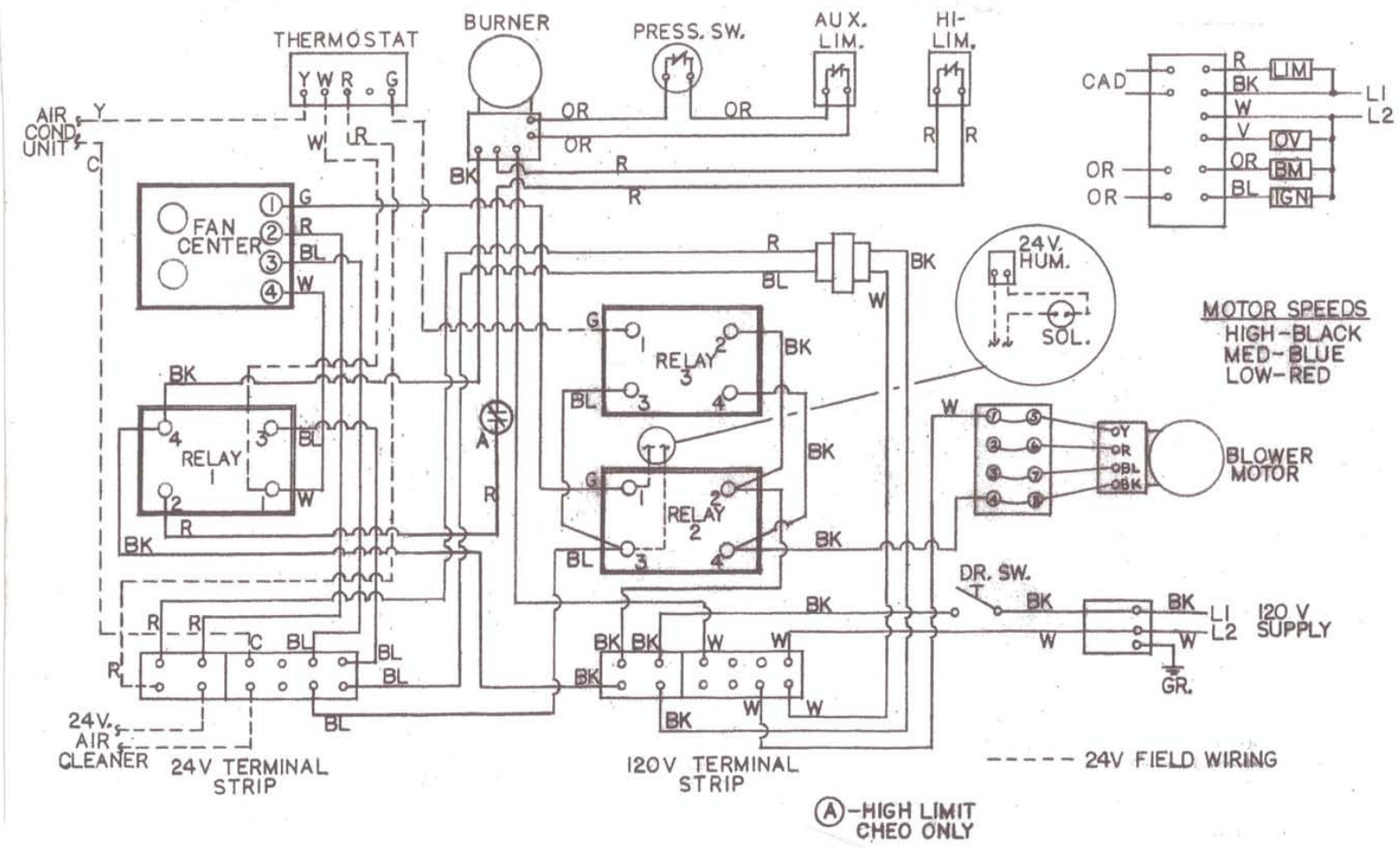

Relay #1 Burner	Relay #2 Heating	Relay #3 Cooling

Wiring Diagram

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! WARNING

HIGH VOLTAGE!
TO AVOID THE RISK OF INJURY, ELECTRICAL SHOCK OR DEATH, THE FURNACE MUST BE ELECTRICALLY GROUNDED IN ACCORDANCE WITH LOCAL CODES OR IN THEIR ABSENCE, WITH THE LATEST EDITION OF THE NATIONAL ELECTRIC CODE.

To ensure proper unit grounding, the ground wire should run from the furnace ground screw located inside the furnace junction box all the way back to the electrical panel.
NOTE: Do not use oil piping as an electrical ground. To confirm proper unit grounding, turn off the electrical power and perform the following check:

1. Measure resistance between the neutral (white) connection and a suitable chassis ground.
2. Resistance should measure 10 ohms or less.

This furnace is equipped with a blower door interlock switch which interrupts unit voltage when the blower door is opened for servicing. Do not defeat this switch.

24 Volt Thermostat Wiring

NOTE: Wire routing must not interfere with circulator blower operation, filter removal, or routine maintenance.
Low voltage connections can be made through either the right or left side panel. Thermostat wiring entrance holes are located adjacent to the junction box locations in the blower compartment.

Thermostat Diagram

This furnace is equipped with a 40 VA transformer to facilitate use with most cooling equipment. Consult the wiring diagram, located on the blower compartment door, for further details, of 115 Volt and 24 Volt wiring.

VIII. CONDENSATE DRAIN LINES & DRAIN TRAP

GENERAL

A condensing oil-fired furnace achieves its high level of efficiency by extracting almost all of the heat from the products of combustion and cooling them to the point where condensation takes place.

The condensate which is generated must be piped to an appropriate drain location. The furnace's drain hoses may exit either the right or left side of the furnace.

In horizontal installations, the drain hoses will exit through the bottom (down side) of the unit with the drain trap suspended beneath the furnace.

The field-supplied drain system must be in accordance with all local codes and the instructions in the following sections.
Follow the instructions below when installing the drain system.
Refer to the following sections for specific details concerning furnace drain trap installation and drain hose hook ups.

The drain trap supplied with the furnace must be used.

DRAIN TRAP ASSEMBLY

Check for proper fit of the entire assembly Before cementing the individual components together. Place the flexible pipe coupling on the sub protruding from the 90 degree elbow connected to the condensate collector, then insert the 6 inch pipe stub and tighten the clamps on each end of the flexible coupling.
Attach the tee to the stub coming out of the furnace and insert 10 inch stub to bottom of the tee. Attach the trap assembly to the bottom of the stub using PVC pipe coupling. **Do Not use pipe cement on the flexible pipe coupling.** Add water to the trap until some runs out of the drain overflow. Do not install the drain in areas subject to freezing.

DRAIN CONNECTION

Insert the ½ inch ID tubing through the hole in the cabinet and press on to the barb fitting. **Do not use excessive force on the drain pan.** Connect the other end to the top 90 degree barb on the drain trap assembly. Connect another piece of tubing to the bottom of the tee on the drain trap and run to the condensate neutralizer. The condensate neutralizer must lay in a horizontal position. Connect installer furnished tubing (type UVT or equivalent, ½" ID) to the other end of the condensate neutralizer and run to a drain. Do not install the drain in areas subject to freezing.

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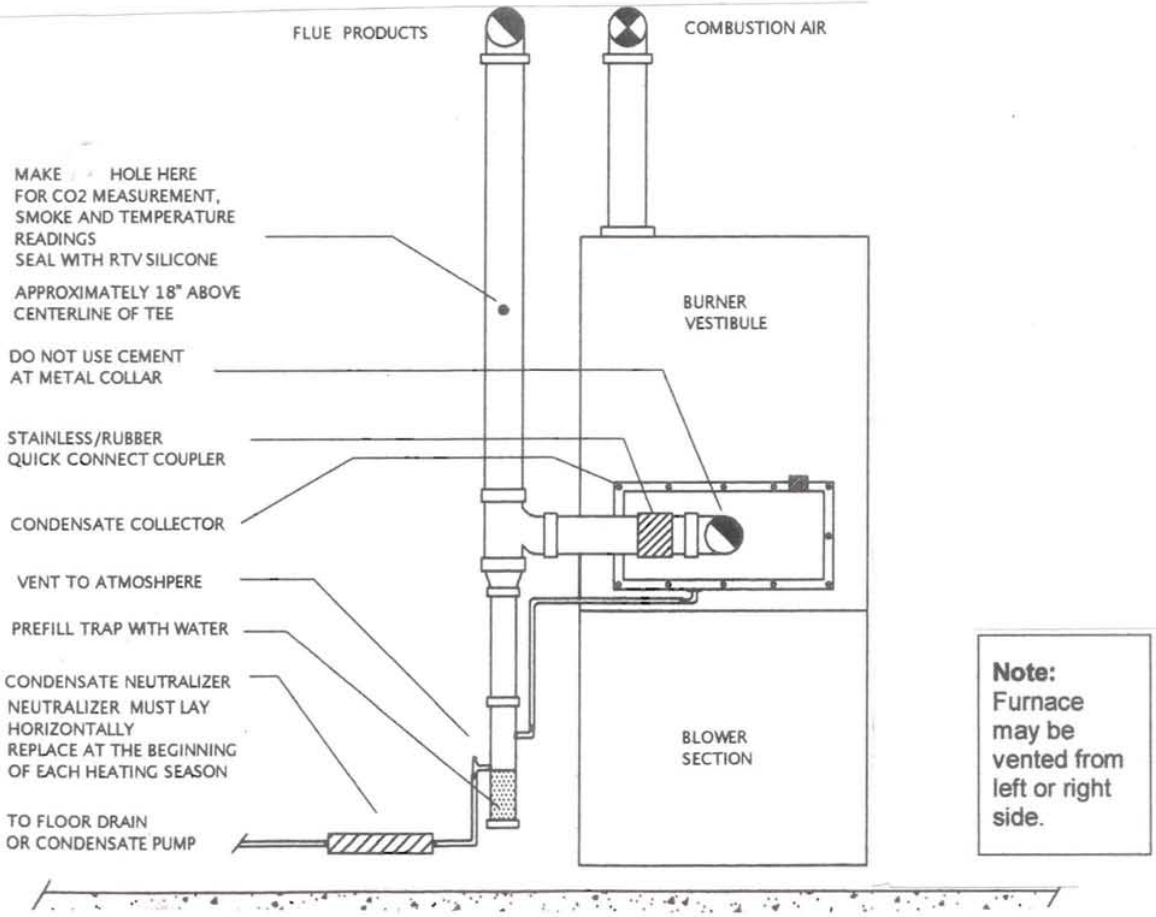

IX. OIL LINE

GENERAL

The furnace rating plate includes the approved furnace input rating and fuel types. The furnace must be equipped to operate on the type of oil applied.

CAUTION !

TO PREVENT UNRELIABLE OPERATION OR EQUIPMENT DAMAGE, THE OIL LINE PRESSURE MUST BE SET AT 140 P.S.I.

OIL TANK

Oil storage tanks must be selected and installed in compliance with applicable codes; in the United States, NFPA 31, Standard for the Installation of Oil Burning Equipment, Chapter 2, and in Canada, **CAN/CSA-B139,** Installation Code for Oil Burning Equipment, Section 6. Observe all local codes and by-lays. In general, the oil tank must be properly supported and remain stable in both empty and full conditions. The oil tank must be fitted with vent and supply pipes to the outdoors. Refer to the above-mentioned codes for sizing. The vent pipe must be no less than 1 ¼ inches I.P.S., and terminate with an appropriate vent cap in a location where it will not be blocked.

The fill pipe must be no less than 2 inches I.P.S., and terminate with an appropriate cap in a location where debris will not enter the fill pipe during oil delivery.

If located indoors, the tank should normally be in the lowest level, (cellar, basement, etc.). it must be equipped with a shut-off valve at the tank outlet used for the oil supply. The oil tank must be located as to not block the furnace/room exit pathway. Observe all clearances specified in the above-mentioned codes.

PIPING INSTALLATION

In the United States, **NFPA 31,** Standard for the Installation of Oil Burning Equipment, Chapter 2.

In Canada, the entire fuel system should be installed in accordance with the requirements of CAN/CSA B139, and local regulations. Use only approved fuel oil tanks, piping, fittings, and oil filters.

Ensure that all fittings used in a copper oil line system are high quality flare fittings. Do not use compression fittings. Do not use Teflon tape on any fittings.

Pressurized or gravity feed installations must not exceed 3 PSIG. Pressures greater than 10 PSIG may cause damage to the shaft seal. If the height of the oil stored in a tank above the oil burner exceeds 11 ½ feet, it may be necessary to use a pressure-regulating device approved for this purpose.

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The furnace may be installed with a one-pipe system with gravity feed or lift. The maximum allowable lift on a single line system is 8 feet. Lift should be measured from the bottom (outlet) of the tank, to the inlet of the burner. Sizing a single line system is complex because of the difficulty estimating the pressure drop through each fitting, bend and component in the line. In general, keep single line systems short as possible. Two-stage oil pumps are available for either the **INTER**burner or Beckett burner.

The following chart shows the allowable line lengths (horizontal & vertical) for single and two stage oil pumps. All distances are in feet.

In retrofit applications, where an existing oil line system is in place, a vacuum check will help determine the integrity of the existing oil line system. The vacuum in a system should not exceed 6" Hg. For a single pipe system, not 12" Hg. For a two-pipe system.

To eliminate air leakage, fuel line should be a continuous length from tank to burner and flare fittings must be used on all connections. On threaded connections, use pipe dope that is resistant to fuel oil (Rector seal #5, Permatex or equivalent). **Do not use PTFE joint tape.**

OIL LINES

Copper Tubing Oil Line Lengths (Feet)

	Single-Pipe		Two-Pipe	
Lift Ft.	3/8" O.D Tubing	½" O.D Tubing	3/8" O.D. Tubing	½" O.D. Tubing
0	53	100	68	100
1	49	100	65	100
2	45	100	63	100
3	41	100	60	100
4	37	100	58	100
5	33	100	55	100
6	29	100	53	100
7	25	99	50	100
8	21	83	48	100
9	17	68	45	100
10	13	52	42	100
12	-----	-----	37	100
14	-----	-----	32	100
16	-----	-----	27	100
18	-----	-----	22	88

For additional information, see the installation information sheet included in the documents envelope or affixed to the oil burner and ***R.W. Beckett Bulletin (664805)***

Solving After Drip and Locating Oil Line Leaks Bulletin (664822).

NOTE: Both the **INTER**burner AND Beckett oil burners require the use of a bypass plug when converting from single-pipe to two-pipe oil piping systems. See burner manufacturer's instructions.

X. CIRCULATING AIR & FILTERS

Ductwork - Air Flow

Duct systems and register sizes must be properly designed for the CFM and external static pressure rating of the furnace. Design the ductwork in accordance with the recommended methods of "Air conditioning Contractors of America" Manual D. Install the duct system in accordance with Standards of the National Board of Fire Underwriters for the installation of Air Conditioning, Warm Air Heating and Ventilating Systems. Pamphlets No. 90A and 90B.

A closed return duct system must be used, with the return duct connected to the furnace.

NOTE: Ductwork must never be attached to the back of the furnace.

Flexible joints may be used for supply and return connections to reduce noise transmission. To prevent the blower from interfering with combustion air or draft when a central return is used, a connecting duct must be installed between the unit and the utility room wall. Never use a room, closet, or alcove as a return air chamber.

No furnace will operate or heat properly if the duct work it is attached to is not sized or installed correctly. Warm air runs should have dampers installed so that they can be balanced room to room. Dampers should be adjusted to provide a minimum of 0.20 and a maximum of 0.50 inches water column external static pressure in the warm air plenum.

Keep in mind that 95% of all burner and pump problems are caused by three factors:
Air leak in the fuel line, improperly sized fuel lines and dirty fuel.

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When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace and, if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position.

FILTERS - READ THIS SECTION BEFORE INSTALLING THE RETURN AIR DUCTWORK

A FILTER MUST BE USED WITH THIS FURNACE. Discuss filter maintenance with the building owner. Filters are shipped with this furnace. Filters must comply with UL900 or CAN/ULCS111 standards.
If the furnace is installed without filters, the warranty will be voided.

Inspect Filter Frequently!
Replace 3 times each heating season.

XI. START-UP PROCEDURE & ADJUSTMENT

Please read the procedures outlined below and familiarize yourself with the appliance sequence of operation before conducting any tests or starting the appliance.

Note: A separate start-up form is attached to the installation instructions and must be completed and returned to the manufacturer for warranty registration within 30 days of installation.

Check that furnace is installed level. This is important since the secondary heat exchanger is pitched at 3 degrees for proper condensate drainage. Check with a carpenters level and shim accordingly.

Verify that the fuel supply lines are leak-free. Inspect all connections for air leaks. Fuel system integrity is often assumed, but cannot be overlooked. **Test** the fuel system for integrity. Even a small leak can cause a multitude of burner issues. Never use compression fittings.

Verify pump pressure with appropriate test instrument. (140 PSI) for Adams INTERburner Mark 10 or Beckett NX.

Check pump seal by shutting off pump and noting the pressure drop. The pump pressure should drop approximately 20% and hold indefinitely.

Prime oil filter supplied with the appliance before bleeding air from system. Purge the oil pump of air in the system as soon as the burner motor starts rotating by opening bleeder valve on pump and catch oil in suitable container.

Check post-purge timing on primary safety control by examining dip-switch configuration on the primary control. This control is factory set at 8 minutes post purge time.

Locate fan control in blower compartment. Check **blower-on** time delay. Set delay for 30 seconds.

Verify blower-off delay setting at 390-600 seconds. This is required for proper heat removal from the heat exchanger once the thermostat is satisfied.

Do not remove blower deck support bracket located in the blower compartment. This bracket may be confused for a shipping bracket and must **not** be removed. This bracket is installed in up-flow and counter-flow models only. It is a sheet metal support bracket in the blower compartment.

Prime condensate drain trap with water.

Operate the burner for (3) minutes on, (3) minutes off twice. Operate the burner for approximately 30-40 minutes to **cure the internal ceramic fiber combustion chamber.** Be aware of moderate odor/smoke upon initial firing and gradually diminishing to normal over the break-in period. Note the air handler should be **operating at all times** during the break-in period and final tuning.

You are now ready for the final fine-tuning.

The **burner air settings are approximate** and needs to be adjusted to the vent system in the field for most efficient operation.

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Drill a 3/8" hole in the PVC exhaust vent piping approximately 18" above where the PVC exits the side of the furnace for your combustion analysis equipment. (Seal with RTV silicone when finished conducting combustion analysis).

BURNER ADJUSTMENT

1) Operate burner for 15 minutes before conducting test work.
2) Adjust burner settings until a trace (0-1 on a smoke scale of 10) is obtained with smoke test pump.
3) Read **CO2%.** This should be approximately 13.0%.
4) Increase air to burner to reduce CO2% 1.0 to 1.5% less than where you were able to obtain a trace of smoke.
This procedure allows a margin of reserve for variable conditions.

5) Re-check smoke to insure it is 0.
Your final CO2% should be approximately 11.5%

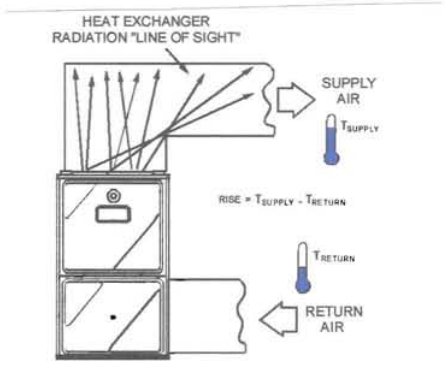
Check vent stack temperatures as below:

MODEL	APPROX. AMBIENT PLUS STACK TEMP F.	INPUT RATE	THERMAL EFFICIENCY
50	20-24	58,000	97-99%
75	27-31	82,000	95-97%
100	29-33	100,000	94-96%
125	38-42	115,000	92-94%

Temperature Rise
Temperature rise must be within the range below. An incorrect temperature rise may result in condensing in or overheating of the heat exchanger.
Determine and adjust temperature rise as follows:

Model	Temp. F. Degree Rise
50-2.5	50-60
75-2.5	55-65
100-2.5	60-70
50-5	30-40
75-5	35-45
100-5	45-55
125-5	50-60

1. Operate furnace with burner firing for approximately ten minutes. Ensure all registers are open and all duct dampers are in their final (fully or partially open) position.
2. Place thermometers in the return and supply ducts as close to the furnace as possible. Thermometers must not be influenced by radiant heat by being able to "see" the heat exchanger



Temperature Rise Measurement

3. Subtract the return air temperature from the supply air temperature to determine the air temperature rise. Allow adequate time for thermometer readings to stabilize.
4. Adjust temperature rise by adjusting the circulator blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

Set thermostat heat anticipator setting at 0.2 A as a base point. Operate furnace and measure anticipation amperage and adjust thermostat to manufacturer's instructions.

CIRCULATOR BLOWER SPEEDS
This furnace is equipped with a multi-speed circulator blower. This blower provides ease in adjusting blower speeds. These blower speeds should be adjusted by the installer to match the installation requirements so as to provide the correct heating temperature rise and correct cooling CFM.
To adjust the circulator blower speed, proceed as follows:
1. Turn OFF power to the furnace.
2. Relocate desired motor leads to the circulator blower terminals on the terminal block as required.
3. Turn ON power to furnace.
4. Verify proper temperature rise as outlined in Section XIV, Startup Procedure and Adjustment - Temperature Rise.

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Circulator Blower Speeds

Low	Red
Medium	Blue
High	Black
Common/Neutral	White

XII. NORMAL SEQUENCE OF OPERATION

POWER UP MODE
The normal power up sequence is as follows:

- 115 VAC power applied to furnace
- Furnace awaits call from thermostat

HEATING MODE

The normal operational sequence in heating mode is as follows:

- R and W thermostat contacts close, initiating a call for heat

Closure of the thermostat switch through relay #1 energizes primary control on the burner. Primary control goes in the pre-purge cycle, runs for 15 seconds and then goes into ignition sequence, burner ignites.

Blower operation is controlled by **Blower Delay "On-Off" Control Relay,** mounted in control panel face of blower.
With factory setting (DELAY ON MAKE) of (30 sec), approximately 30 seconds after burner ignites, blower relay energizes to run comfort blower in the heating speed mode.

NOTE:
Blower speed (heating) is factory set on high speed.

THERMOSTAT SATISFIED
When the thermostat satisfied, heat contact opens through relay No. 1, primary control relay drops out, which de-energizes the primary control. Burner goes into post-purge cycle, and then shuts off. With factory setting (DELAY ON BREAK) of 600 seconds, comfort blower continues to run for approximately 390-600 seconds after burner is satisfied.

FAN ONLY MODE

The normal operational sequence in fan only mode is as follows:

- R and G thermostat contacts close, initiating a call for fan
- Circulator blower is energized
- Circulator blower runs
- R and G thermostat contacts open, completing the call for fan
- Circulator blower is de-energized
- Furnace awaits next call from thermostat

COOLING MODE

When the heat-cool switch is in the cool position, and the thermostat calls for cooling, 24 volts AC at C and Y will complete the circuit to contactor in condensing unit.

XIII. TROUBLESHOOTING

IMPORTANT:
DUE TO THE POTENTIAL HAZARD OF LINE VOLTAGE, ONLY A TRAINED, EXPERIENCED SERVICE TECHNICIAN SHOULD PERFORM THE TROUBLESHOOTING PROCEDURE.

PRELIMINARY STEPS:
Check the diagnostic light for indications of burner condition. Refer to R7184 LED Diagnostic Light section for details.

CAUTION !

When simulating a call for heat at the R7184, disconnect at least one thermostat lead wire from the T - T/3 terminals to prevent damage to the thermostat. Neglecting this procedure may burn out the heat anticipator of a standard 24 VAC thermostat, or cause harm to components of a micro-electronic thermostat.

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Table 1 System and General Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Furnace will not start	Thermostat not calling for heat.	Check thermostat and adjust. Be sure it is accurate. If it is mercury type be sure it is level.
	No power to furnace.	Check furnace switch and main electrical panel furnace fuse or circuit breaker.
	Thermostat faulty.	Remove thermostat wires from the oil primary control terminal T-T. Put a jumper across T-T. if furnace starts, replace thermostat, thermostat sub-base or both.
	Oil primary control faulty.	Check reset button on oil primary control. Remove thermostat wire from oil primary control terminal T1 –T2. Check for 24 v. across T-T. If mo voltage is present, check for 115 v. to oil primary. If 115v. is present go t o primary control diagnostics.
	Cad cell wiring shorted or room light leaking into cad cell compartment.	Check cad cell wiring for short circuits. Check for room light leaking into cad cell compartment.. Repair light leak if necessary.
	Open safety switch	Check for open high limit, auxiliary limit, pressure or door interlock switch.
Furnace will not start without first pushing oil primary control reset button. **(Occurs frequently)**	No Fuel oil	Check fuel oil supply. Check that all hand operated fuel oil valves are in the open position. Fill oil storage tank if necessary.
	Clogged nozzle.	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter.	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure.	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Ensure that erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective.	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for any signs of oil leaks. Any oil leak is a potential source of air or contaminants.
	Defective burner motor.	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.
Furnace starts, but shuts off requiring manually resetting the primary control reset button.	Cad cell is dirty or defective	If cad cell is dirty, clean it. (Determine why cad cell is getting dirty). If cad cell is poorly aimed, realign it. NOTE: The photocell should have a resistance of 100K ohms in absence of light, a maximum of 1500ohms in the presence of light. Ensure that room light is not leaking into the cad cell compartment. (See diagnostic light section).
	No fuel oil.	Check fuel oil supply. Check that all hand operated fuel oil valves are in the open position. Fill oil storage tank if necessary.
	Clogged nozzle.	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter.	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure.	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Ensure that erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective.	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for any signs of oil leaks. Any oil leak is a potential source of air or contaminants.
	Defective burner motor.	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.
	Water or contaminants in oil.	Drain fuel oil storage tank and replace fuel oil. (Consult with fuel oil supplier).
	Frozen oil line.	Gently warm oil line. Insulate oil line. (Outdoor piping size may require increased diameter).

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Table 1 System and General Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Oil burner sputtering at nozzle	Electrodes out of adjustment or defective.	Check electrode settings. Check electrodes for dirt build-up or cracks in porcelain.
	Poor transformer high voltage connections or defective transformer.	Check contacts between the igniter and electrodes. If OK, replace the igniter.
	Fuel oil filter clogged.	Replace fuel oil storage tank filter and/or fuel oil in-line filter.
	Defective oil pump.	Check burner motor/fuel oil pump coupling. Check oil pump pressure. Replace fuel oil pump if necessary.
	Fuel oil line partially clogged or contains air.	**Bleed air from oil line.** **If problem persists, replace oil line.**
Check stack temperature.	System temperature rise too high.	"Refer to start up procedure for correct temperature rise. Check for clogged air filters. Check blower fan for excess dirt build-up or debris. Speed up blower fan if necessary.
	Poor "fan off" delay timing selection, (fan stops too soon) Fan control timer.	Check "fan off" delay timing setting for a delay off between 390 and 600 seconds.
	Fuel oil leak.	Check fuel oil line for leaks. Repair or replace if necessary.
	Stack temperature too high.	Check stack temperature. Stack temperatures will normally range from 20-42 degrees above ambient.
	Thermostat improperly adjusted or in poor location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If the thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to more suitable location.
More than (0) smoke	Insufficient combustion air at oil burner	Adjust oil burner combustion air to gain the highest CO2 or lowest practical O2 content in the flue gas (see Burner Set Up).
	Heat exchanger partially blocked	Check for soot build up in turbulators of secondary heat exchanger
Soot build up on the blast tube (end coning),	Poor alignment of between oil burner blast tube and fire pot.	Check alignment. Blast tube should be centered with fire pot burner opening. Oil burner head should be ¼ inch back from the inside surface of the fire pot.
	Flame impingement caused by incorrect nozzle angle.	Check nozzle size and angle. Check distance from head to inside surface of the fire pot.
	Defective fire pot.	Check fire pot. Repair or replace.
Furnace will not warm home to desired temperature.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Thermostat adjustments or location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If the thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to more suitable location.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
	Defective high limit control.	Test high limit function of all limit switches. Use a duct thermometer to assess accuracy of limit control. Check for obstructions to airflow around limit switch bi-metal elements. Replace control if necessary. NOTE: A. high limit is auto-reset. B. Auxiliary limit is manual re-set.
	Under-sized nozzle.	Check nozzle. If problem is not caused by air flow problems, use larger nozzle, if permitted by rating plate.
	Blower fan motor stopping intermittently on overload	Check blower fan motor amperage draw. Check motor ventilation ports, clean if necessary. Replace motor if necessary.
	Burner motor stopping intermittently on overload.	Check burner motor. Replace if necessary

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Table 1 System and General Troubleshooting

PROBLEM	POSSIBLE CAUSE	REMEDY
Home does not heat evenly.	Improper distribution of heat.	This is unlikely to be a furnace problem. Balance duct system with dampers.
Supply air temperature too hot.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
Supply air temperature too cool.	Excess airflow.	Check system temperature rise. Slow down blower fan is necessary.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.
Supply air temperature too cool during first moments of furnace cycle.	Fan control "fan on" setting too low.	Increase "fan on" time. Register air deflectors may help.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.

XIV. Maintenance & Annual Inspection

1) Replace Delevan nozzle with exact capacity, angle and pattern as supplied.
2) Replace vestibule mounted oil filter with AF-1 filter.
3) Replace condensate neutralizer with part number CCR-1.
4) Remove air handler assembly (slide out) and inspect the bottom (upflow configuration) of the secondary heat exchanger. Loosen accumulated foreign matter with soft brush and vacuum clean.
5) Perform all routine safety switch function checks.
6) Perform combustion analysis as described on page 18 Burner Adjustment.
7) Do not remove rear access panel of heat exchanger. Internal cleaning of the primary or secondary heat exchangers are not required (unless satisfactory combustion analysis cannot be achieved).

! CAUTION

The ceramic combustion chamber located in the primary heat exchanger **should not** be handled once it is cured at startup. Structural damage will occur, if handled and if broken the furnace will be rendered inoperative.

NOTE:

If the secondary heat exchanger turbulators have a light coating of soot, this is normal and will not affect the efficiency of the furnace.

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XV. REPAIR & REPLACEMENT PARTS

Item No.	Description	Part No. 2.5 Tons Cooling	Part No. 5 Tons Cooling
1	BURNER COMPATMENT DOOR	A10001 HEO	SAME
1A	BLOWER COMPATMENT DOOR	A1011 HEO	SAME
3	OIL FILTER HEAD	A-1	SAME
3A	OIL FILTER CARTRIDGE	A-2	SAME
4	HIGH LIMIT SWITCH	36TV01	SAME
4A	HIGH LIMIT SWITCH (counterflow only)	36TV01A	SAME
5	V ESTBULE PANEL	A1071HEO	SAME
6	BURNER TUBE SHIELD	A3001HEO	SAME
7	COMBUSTION CYLINDER COVER	A3011HEO	SAME
9	COMBUSTION CHAMBER	A3041HEO	SAME
10	HEAT EXCHANGER	A3051	SAME
10a	REAR ACCES DOOR	3052HEO	SAME
10B	REAR ACCCESS COVER GASKET	A3053HEO	SAME
11	CABINET LEFT SIDE	A1081HE0	SAME
12	CABINET TOP	A1091HEO	SAME
12A	AIR BAFFELS (2)	A1091AHEO	SAME
12B	VESTIBULE SUPPORT BRACKET (2)	A1081BHEO	SAME
13	REAR COMPARTMENT DOOR	A1101HEO	SAME
14	CABINET RIGHT SIDE	A1111HEO	SAME
15	AIR FILTER (Not Shown))	F2025	SAME
16	FILTER RACK	20X25FF	SAME
17	AIR FLOW SWITCH (INTERburner)	A2041HE0	SAME
17A	AIR FLOW SWITCH (BECKETT NX)	A2041HEO-A	SAME
17B	DIRECT VENT KIT (BECKETT NX)	A4000NX	SAME
18	CONDENSATE COLLECTOR BOX	A1151HEO	SAME
19	FRONT COIL GASKET	1161HEO	SAME
20	HEAT RECOVERY COIL	A3061HEO	SAME
21	REAR COIL GASKET	1181HEO	SAME
22	HEAT EXCHANGER SUPPORT (RIGHT)	A3071HEO	SAME
23	HEAT EXCHANGER SUPPORT (LEFT)	A3081HEO	SAME
24	COMBUSTION CHAMBER SUPPORT (RIGHT)	A3111HEO	SAME
25	COMBUSTION CHAMBER SUPPORT (LEFT)	A3121HE0	SAME
26	BLOWER DIVISION PANEL	A1191HE0	SAME
27	DOOR SWITCH	2001HEO	SAME
28	BLOWER COMPLETE LESS MOTOR	PD0909	PD1212
29	BLOWER WHEEL ONLY (Not Shown))	WHLASY09	WHSASY12
30	CAPACITOR	5MFD	10MFD
31	MOTOR MOUNT GROOMET & SLEEVE ((Not Shown))	-	A1201HEO
32	BLOWER MOTOR	MTR13DD	MTR34DD
33	BLOWER MOTOR MOUNT	-	A1311HEO
34	CABINET BASE	A1291HEO	SAME
35	3' SS HOSE CLAMP	A2010HEO	SAME
36	CONDENSATE DRAIN TRAP (SHEO A2011 SHEO)	A2011HE0	SAME
37	CONDENSATE NEUTRALIZER	2021HEO	SAME
38	NEUTRALIZER REFILL	CCR-1	SAME
39	COIL TURBULATORS (60- ½" or 40- 5/8" specify size)	A3041HEO	SAME
40	AUXILLARY LIMIT SWITCH	60T14-205960A	SAME
41	TRANSFORMER	GH1033	SAME
42	FAN TIMER	CTVS24A	SAME
43	RELAY (1), RELAY (2), RELAY (3)	M-3212	SAME
44	RELAY (1), RELAY (2), RELAY (3)	M-3212	SAME
45	24 VOLT TERMINAL STRIP	AGH1059	SAME
46	110 VOLT TERMINAL STRIP	AGH1059	SAME
47	BLOWER MOTOR TERMINAL BLOCK	EE8201	SAME
48	CONTROL ACCESS COVER	A3122HEO	SAME
49	CONTROL PANEL COMPLETE	A3123HEO	SAME
49A	CONTROL PANEL COMPLETE (LHEO)	A3123LHEO	SAME
50	HEAT EXCHANGER REBUILD KIT	A3051RBK	SAME

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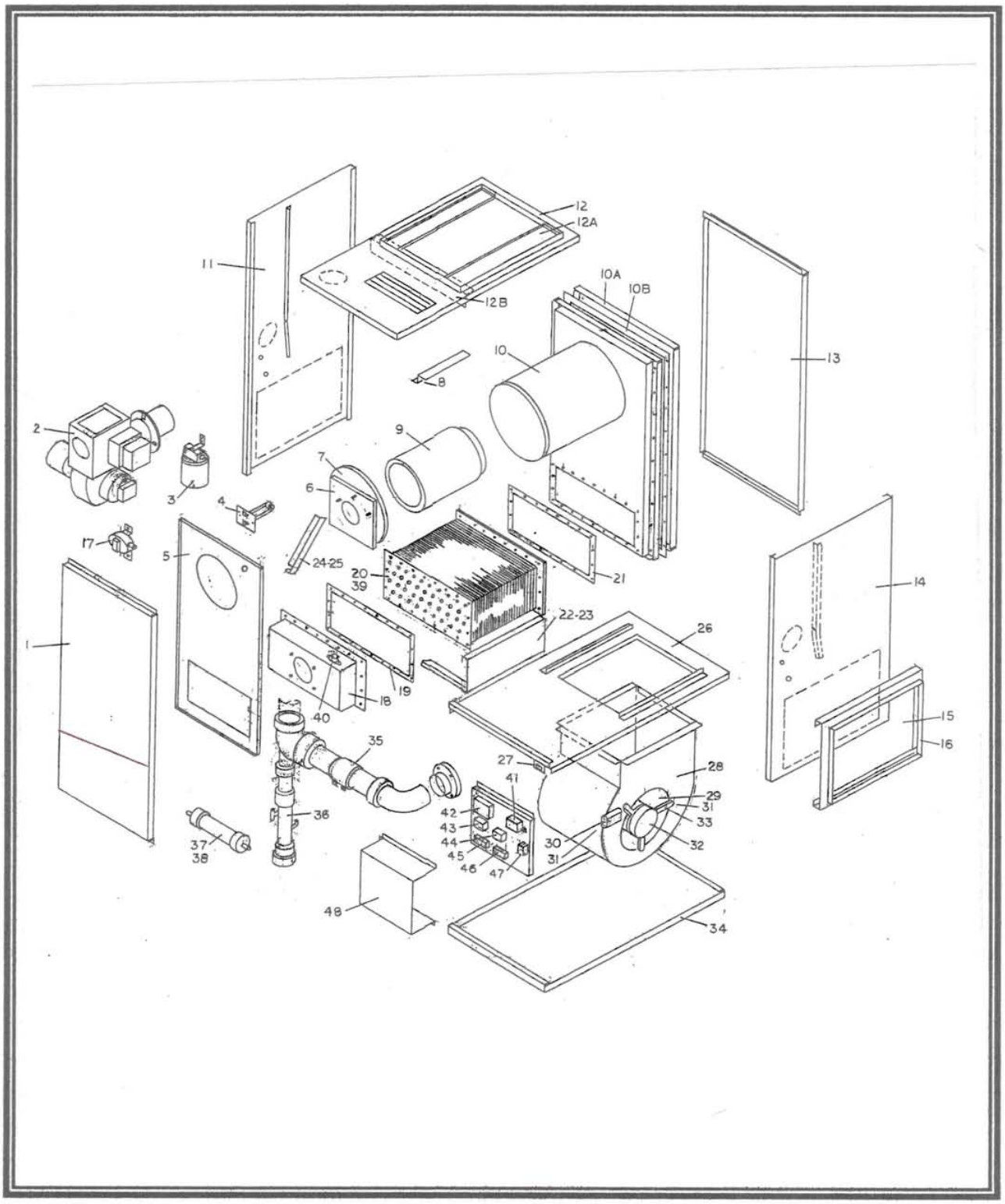
Furnace Assembly Drawing



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